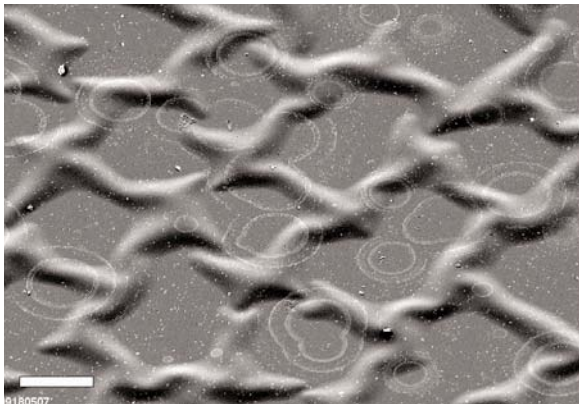
Materials Characterization

Manufacturing Technologies

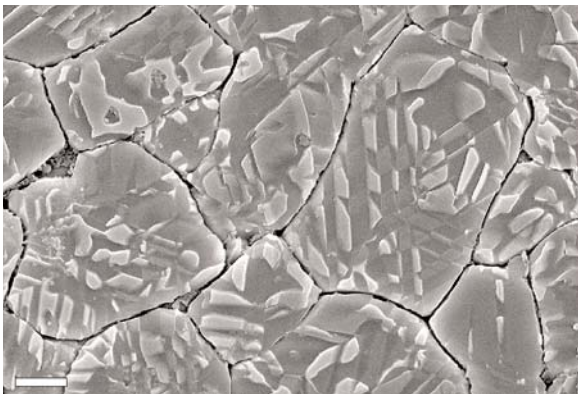
The Manufacturing Science and Technology Center provides a broad range of techniques to characterize organic materials. These techniques assist you in understanding and improving the materials and processes used (e.g., encapsulants, adhesives, composites).

Capabilities

- *Thermal Analysis:* Determine glass transition temperature (Tg), heat capacity (Cp), heat of cure, curing reaction kinetics, glassy and rubbery modulus, coefficient of thermal expansion, volatile and organic content, and decomposition temperatures
- *Rheological Testing:* Characterize the rheological properties of liquids, melts and solids
- *Work of Adhesion:* Measure work of adhesion between polymeric materials (JKR)
- *High Resolution Video Imaging System:* Measure both static and kinetic data over large and small areas; flow visualization
- *Qualification of Alternative Materials and Processes:* Identify and qualify alternative materials to replace toxic and/or carcinogenic materials, addressing both long and short term compatibility issues
- *Electron (SEM) and Optical Microscopy:* A full range of macro to 2000X optical imaging. SEM capabilities: up to 60kx imaging SE and BSE detection, and ESEM low vacuum (charge dissipation, etc.) options. EDS x-ray analysis for spectrum collection (element identification), line mapping, and area mapping.



SEM micrograph of carbon film (marker = 50 microns)



SEM micrograph of etched PZT (marker = 2 microns)

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National Nuclear Security Administration

Sandia National Laboratories

Differential Scanning Colorimetry

Complete sample preparation including low/high speed saws, potting, polishing, and etching.

- *Interfacial Properties Analysis:* Static and Dynamic Contact Angle, Surface Tension
- *Dielectric Measurements:* Dielectric measurements for cure kinetics, flow properties, etc.

Resources

- Thermal Analysis (DSC, TMA, TGA, DMA)
- Rheological Testing
- Work of Adhesion - JKR
- Optical Imaging
- Scanning Electron Microscopy (ESEM)
- Elemental Analysis (EDS)
- Dynamic and static contact angle measurements
- Dielectric measurement apparatus

Accomplishments

- Developed a method to measure work of adhesion
- Developed method to determine the cure profiles of elastomers based on their changing dielectric properties
- Developed a set of metrology tools to characterize flow of encapsulants for underfilling flip-chip packages

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